



# Solar USB Charger

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## TOOLS:

- [Heat gun \(1\)](#)  
*or pocket lighter.*
- [Multimeter or Continuity Tester \(1\)](#)
- [Soldering Iron, 15-Watt \(1\)](#)  
*from RadioShack.*
- [Wire cutter/stripper \(1\)](#)



## PARTS:

- [Solder, lead-free \(1\)](#)  
*from RadioShack.*
- [Rectifier diode assortment 25 piece \(1\)](#)  
*from RadioShack.*
- [Zener diode, 5.1V, 1N4733A \(1\)](#)  
*from RadioShack.*
- [Solar cell, encapsulated module \(1\)](#)  
*from RadioShack.*
- [Extension cable, USB A/A \(1\)](#)  
*from RadioShack.*
- [Heat shrink tubing, 6" \(1\)](#)  
*from RadioShack.*

## SUMMARY

Charge up your USB devices with the power of the sun. By adding a small solar panel and two diodes to a standard USB cable, you can plug that cable into USB devices needing a recharge. It's so easy. Let's get started.

The Solar USB Charger being tested on a sunny day

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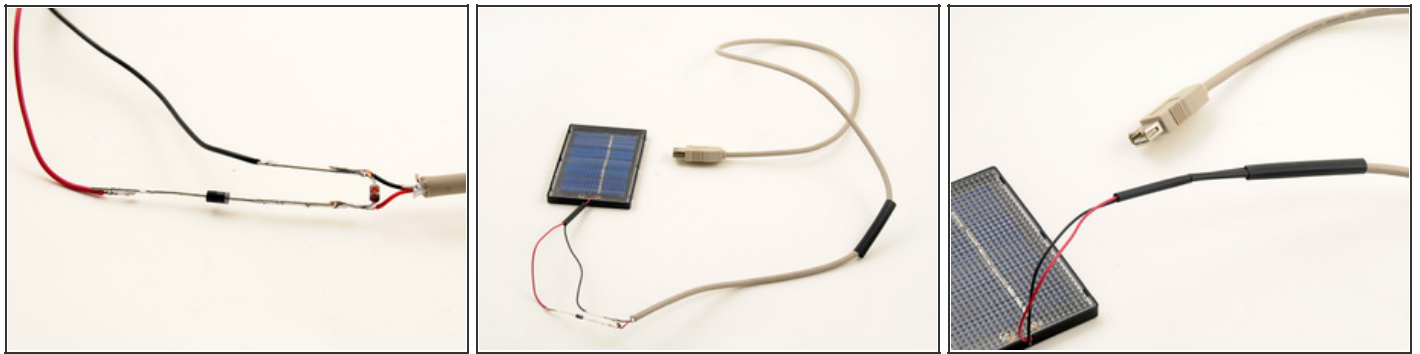
## Step 1 — Hack the cable



- Cut the end off of a USB extension cable. You will need the female end.
- Cut away the cable's outer insulation and isolate the power lines. These are the red wire (+5v), and black wire (Ground). Strip the ends.
- The solar panel already has corresponding red (+) and black (-) wires.



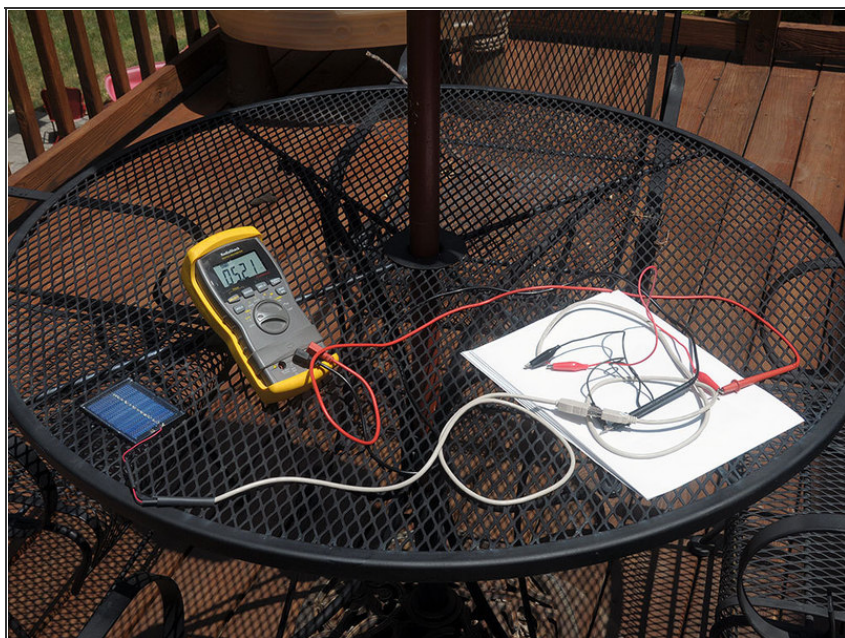
## Step 2 — Add the diodes



- Cut a 2-3" piece of 1/4" heatshrink tubing and slide it over the cut end of the USB cable.
- Cut a similar piece of 1/8" tubing and slide it over either the red or the black wire coming from the solar cell. This tubing will insulate the wiring connections from each other.
- Pick a rectifier diode from the pack; any one of them will do. Solder the diode between the red wires from the solar cell and the USB cable, with its cathode leg (that's the negative side, marked with the stripe) facing the USB side.
- Solder the two black wires directly together.
- Solder the smaller, red and black Zener diode across the two wire connections, with its black stripe facing the red wire side.
- Slide the heat shrink tubing over the joints and shrink with a heat gun or lighter. (Hold the lighter flame over the tubing, rather than under, and move the tubing around to shrink all spots.) Always put the tubing on first, before you solder!



### Step 3 — Test it out!



- The rectifier diode eliminates incorrect polarity and prevents power from being drained from USB devices. The Zener diode protects them by preventing power surges over 5V (actually 5.1V).
- To test your charger's output, place the solar panel in the sun and plug the cut-off end of the USB cable plug back into the other end. Use a multimeter to probe the voltage between the red and black wires.
- Depending on how sunny a day it is, your multimeter should show something between 4V and 5V. The Zener should prevent anything from going too far above 5V.
- I have used this device to charge a 5V USB battery pack. If you want to charge an iPhone, you will need to implement [this modification](#) that raises one of the other USB pins to 2.7V. The iPhone uses this as a signal to detect charging.
- You can see video of the testing of the device in the intro section of this project.

If there's one thing we have in the US, it's sunlight. And where I live, the summers can get incredibly hot. It's a shame to let all of that free energy go to waste, and this project shows you how easy it is to put that solar power to use.

